FIRST LEGO League Core Values

We are a team.

We do the work to find solutions with guidance from our coaches and mentors.

We honor the spirit of friendly competition.

What we discover is more important than what we win.

We share our experiences with others.

We display gracious professionalism in everything we do.

We have fun.

FLL
FIRST LEGO® League

A Special Thanks:

We would like to thank Patrick S. Sweeney for his generous content contributions to the *FIRST LEGO League Coaches' Handbook*.

FLL Coaches' Promise

As the coach of a *FIRST* LEGO® League (FLL) team, please read the information below for further understanding of FLL core values. As coach, you are responsible for honoring and communicating FLL core values to team members, team volunteers, parents, and others affiliated with your team.

All teams are expected to abide by FLL rules and guidelines as they exist now and as they may be set forth during the season. Team rules, guidelines, and policies and procedures are detailed in this handbook. Any updates, additions, participant consent forms, volunteer recruitment, screening, and supervision guidelines for the team will be communicated to FLL coaches via email and posted on the *FIRST* LEGO® League section of www.usfirst.org.

MY PROMISE AS COACH:

1) The children come first. FLL is about the children having fun and getting excited about science and technology. Everything my team does starts and ends with that principle.

2) The children do the work. This is their opportunity to learn and grow. The children on my team do all of the programming, research, problem solving, and building. Adults can help them find the answers, but cannot give them answers or make decisions.

3) My team is comprised of ten or fewer members (all team members participate on only one team), registered as an official FLL team, and all team members are no older than 14 on January 1st of the Challenge year.

4) FLL communicates with my team via my primary email address, and I am responsible for reading and relaying all aspects of FLL guidelines and rules to my team, other coaches, volunteers, and parents.

5) I will encourage my team members, other coaches, volunteers, parents and team supporters to develop and practice a set of FLL Values that reflects *FIRST*'s goal to change culture in a positive way by inspiring others through our team's actions and words.

TABLE OF CONTENTS

About *FIRST*

i . . . . . FLL Coaches' Promise
vii . . . . Biographies

Chapter 1 – Building a Foundation

2. . . . . FLL Values
3. . . . . Gracious Professionalism
3. . . . . The FLL Challenge

Chapter 2 – Building a Team

6. . . . . Advice for Coaches
7. . . . . The Children, The Mentors, and The Parents
10. . . . . Team Dynamics
11 . . . . Time Commitment
12. . . . . Roles and Responsibilities
15 . . . . Team Goals

Chapter 3 – Building a Season

18. . . . . Choosing a Facility
20. . . . . Working with Your Host and Funding a Team
21 . . . . Sample Budget
23. . . . . Challenge Kickoff and Meetings
24. . . . . Team Building
25. . . . . Problem Solving

Chapter 4 – Materials & Mechanics

30. . . . . Materials Defined
33. . . . . Sensors
38. . . . . Object Manipulation
40. . . . . RCX Battery Replacement
42. . . . . Programming Garage

Chapter 5 – The Project

45. . . . . Find a Problem
45. . . . . Create a Solution
46. . . . . Prepare a Presentation
46 . . . . Share Your Project
47 . . . . Prepare Plan B

Chapter 6 – Celebrating Your FLL Season

50. . . . . Host a Local Event
51. . . . . Recognize Your Team Members
52. . . . . Applaud Your Sponsors, Mentors, and Volunteers
52 . . . . Acknowledge Each Person and Salute the Group

Chapter 7 – The Tournaments

54. . . . . Event Types
56. . . . . Applying for a Tournament
57. . . . . Tournament Logistics
59 . . . . Rookie Teams
59. . . . . Tournament Areas
62. . . . . How the Day Works
64. . . . . How Judging Works

Chapter 8 – Awards & Judging Criteria

72. . . . . Awards Eligibility
74. . . . . Judging Guidelines
75. . . . . Champion's Award
76. . . . . Technical Awards
76. . . . . Team Presentation Awards
78. . . . . Special Recognition Awards
78. . . . . Optional Judges' Awards

Chapter 9 – Checklists & Schedules

82. . . . . Pre-Season through Tournament Checklist
84. . . . . FLL Season Schedule and Weekly Milestones
87. . . . . Sample Tournament Schedule

Appendix A: Rubrics

90. . . . . Robot Design
92. . . . . The Project
94. . . . . Teamwork and FLL Values

Appendix B: Additional Resources

97. . . . . Useful Books and Web Links
98. . . . . FLL Support
99 . . . . FLL Forum
100. . . . Kickoff Documents
101. . . . Sample Press Release
102. . . . Applied Engineering Terms and Concepts

ABOUT *FIRST*

"...to create a world where science and technology are celebrated... where young people dream of becoming science and technology heroes."

Dean Kamen, Founder, FIRST

FIRST

FIRST (For Inspiration and Recognition of Science and Technology) was founded by inventor Dean Kamen to inspire young people's interest and participation in science and technology. Based in Manchester, N.H., *FIRST* is a 501 (c) (3) not-for-profit public charity.

A volunteer-driven organization, *FIRST* is built on partnerships with individuals as well as businesses, educational institutions, and government. Some of the world's most respected companies provide funding, mentorship time and talent, and equipment to make *FIRST*'s mission a reality. As a team coach, you join over 45,000 committed and effective volunteers who are key to introducing over 130,000 youths to the joy of problem solving through engineering.

FIRST provides two well-known programs, the *FIRST* Robotics Competition (FRC) for high-school-aged young people and *FIRST* LEGO® League (FLL) for 9 to 14 year-olds. *FIRST* also offers the Junior *FIRST* LEGO League (JFLL) for 6 to 9 year-olds and the *FIRST* Vex Challenge (FVC), an intermediate robotics competition that offers students the traditional challenge of a *FIRST* Robotics Competition but with a more accessible and affordable robotics kit. Also located at *FIRST* headquarters is the research and development facility called *FIRST* Place. *FIRST* Place is integral to FLL game design, new program development, evaluation, and professional development of *FIRST* mentors.

Since 1992, the *FIRST* Robotics Competition (FRC) has challenged high school students — working with professional mentors — to solve an engineering design problem in an intense and competitive way. The program is a life-changing, career-molding experience — and a lot of fun. In 2007, the competition reached more than 32,000 students on over 1,300 teams in 37 regional competitions and one Championship event. Our teams come from Brazil, Canada, Israel, Mexico, the Netherlands, the United Kingdom, and every U.S. state.

In 1998, *FIRST* Founder Dean Kamen and The LEGO Group's Kjeld Kirk Kristiansen joined forces to create *FIRST* LEGO League (FLL), a powerful program that engages younger children in playful and meaningful learning while helping them to discover the fun in science and technology through the *FIRST* experience.

As of 2006, children in 44 countries are active in FLL. We are thrilled to have teams

in Australia, Austria, Bahrain, Belgium, Brazil, Canada, Chile, China, Denmark, Egypt, Faroe Islands, Finland, France, Germany, Greenland, Hong Kong, Hungary, Iceland, India, Israel, Japan, Jordan, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Nigeria, Norway, Palestine, Peru, Portugal, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Turkey, United Arab Emirates, the United Kingdom, and the United States.

"We want to change the culture by celebrating the mind. We need to show kids that it's more fun to design and create a video game than it is to play one."

Dean Kamen
Founder, FIRST

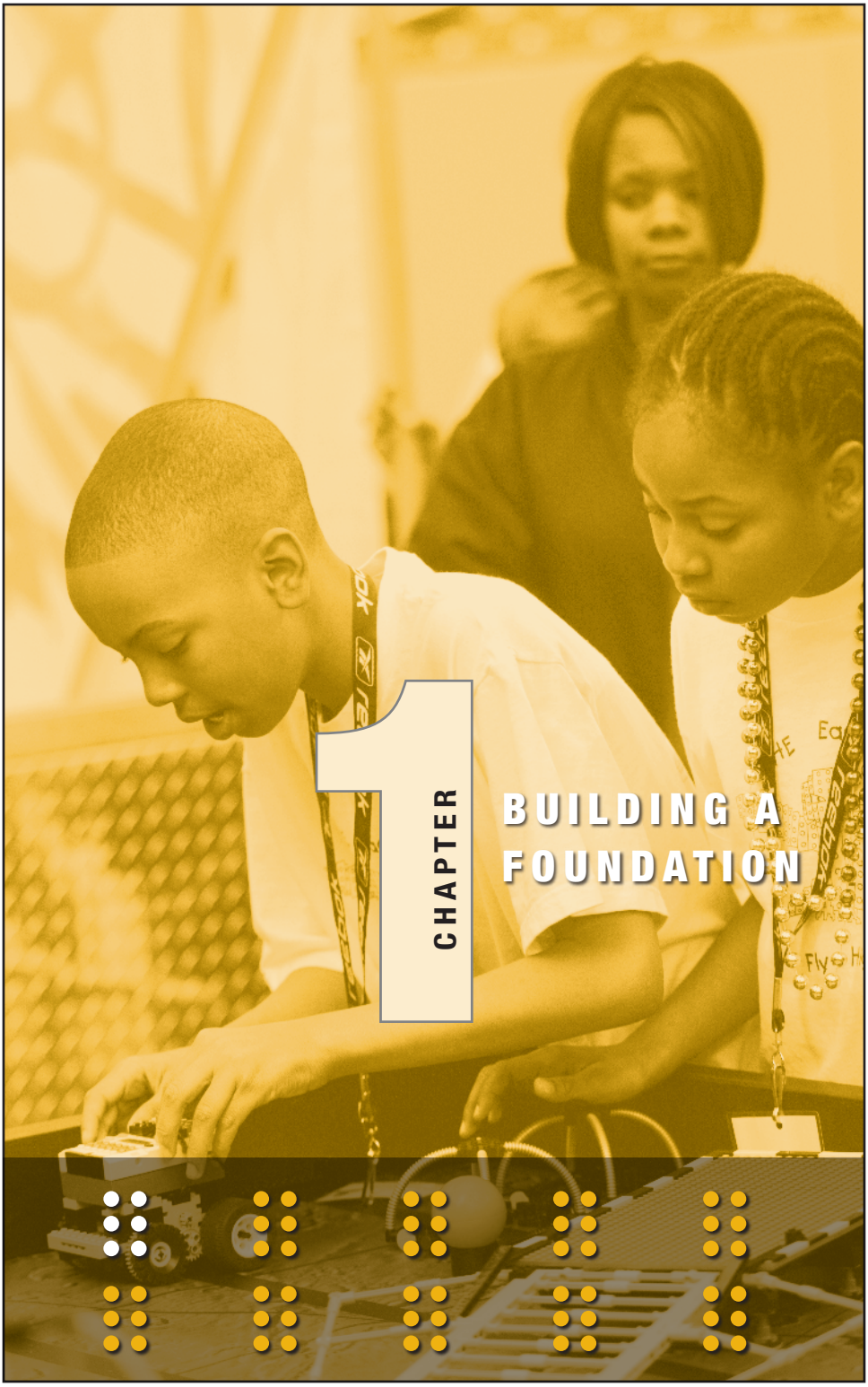
Dean Kamen is President of DEKA Research & Development Corporation, a dynamic company focused on the development of revolutionary new technologies that span a diverse set of applications. As an inventor, physicist, and entrepreneur, Dean has dedicated his life to developing technologies that help people lead better lives. Founding *FIRST* is among Dean's proudest accomplishments.

"FLL encourages children to design, construct, and program their own intelligent inventions. This allows them not only to understand technology, but to become masters of it."

Kjeld Kirk Kristiansen
Owner & Deputy Chairman, The LEGO Group

Kjeld Kirk Kristiansen is the principal shareholder of the 100% family-owned LEGO Group. He is the Vice Chairman of the Board of Directors of LEGO Holding A/S and also Chairman of several of the largest companies in The LEGO Group, which today consists of 50 companies in Denmark and abroad, employing around 7,300 people.

Dean and Kjeld have a shared belief that when FLL teams research, build, and experiment, they live the entire process of creating ideas, solving problems, and overcoming obstacles, while gaining confidence in their abilities to positively use technology.



CHAPTER 1

BUILDING A FOUNDATION

FIRST LEGO® League (FLL) relies on volunteers to run the program at many levels, from managing a region to coaching an individual team. We call our volunteers in each region FLL Operational Partners, or FLL Partners. These FLL Partners fundraise, run tournaments, hold workshops and demonstrations, market FLL locally, handle public relations, and recruit volunteers and teams. They are a tremendous resource for you as a team coach, and FLL would not exist without them.

CORNERSTONES

Our FLL Partners agree to maintain certain standards relative to tournaments, the Challenge, and overall program administration. At the same time, the resources of each FLL Partner vary from region to region. Some FLL Partners are affiliated with major corporations that support *FIRST* and FLL. Others are based in a non-profit that has a complementary mission to FLL, and some are individuals with a passion for our cause, operating out of their homes. For all FLL Partners, their most important goal is to share the FLL program with as many individuals as possible.

TIP

We encourage FLL teams to explore the different sections of the two integrated websites: www.usfirst.org (referred to in this handbook as the *FIRST* site) and www.firstlegoleague.org (referred to in this handbook as the FLL site). You may choose to assign a team member or volunteer to review the sites periodically and update the team. However, as coach, you are ultimately responsible for all communications concerning your team. See the appendix for additional resources on the web.

FLL Values

We ask all who participate in FLL to uphold the following values:

- Respect each other in the best spirit of teamwork
- Behave with courtesy and compassion for others at all times
- Honor the spirit of friendly competition
- Act with integrity
- Demonstrate gracious professionalism
- Focus on the experience and not the awards
- Remember that the children do the work
- Encourage others to adopt these values

Gracious Professionalism

Dr. Woodie Flowers, National Advisor for *FIRST*, speaks about gracious professionalism in this way: "The *FIRST* spirit encourages doing high-quality, well-informed work in a manner that leaves everyone feeling valued. Gracious professionalism seems to be a good descriptor for part of the ethos of *FIRST*. It is part of what makes *FIRST* different and wonderful.

Gracious professionalism can and should mean different things to each of us. It is possible, however, to outline some of its meanings:

- Gracious attitudes and behaviors are "win-win."
- Gracious folks respect others and let that respect show in their actions.
- Gracious professionals make a valued contribution in a manner pleasing to others and to themselves as they possess special knowledge and are trusted by society to use that knowledge responsibly.

In the long run, gracious professionalism is part of pursuing a meaningful life. One can add to society and enjoy the satisfaction of knowing that you have acted with integrity and sensitivity. That's good stuff!"

FLL is a child-centered activity and is about giving children a unique and stimulating experience. We want them to learn the value of teamwork and to respect everyone's ideas and contributions to the team. FLL values are about appreciating our differences and learning what those differences add to our lives. FLL succeeds most fully when team members bring the FLL values they learn back to their communities.

The FLL Challenge

Each September, we provide FLL teams around the world with an annual Challenge. The Challenge is based on a set of real-world problems facing scientists and engineers today. It has two parts: a **robot game** and a **project.**

In the **robot game,** teams design, build, program, and test autonomous

REMINDER

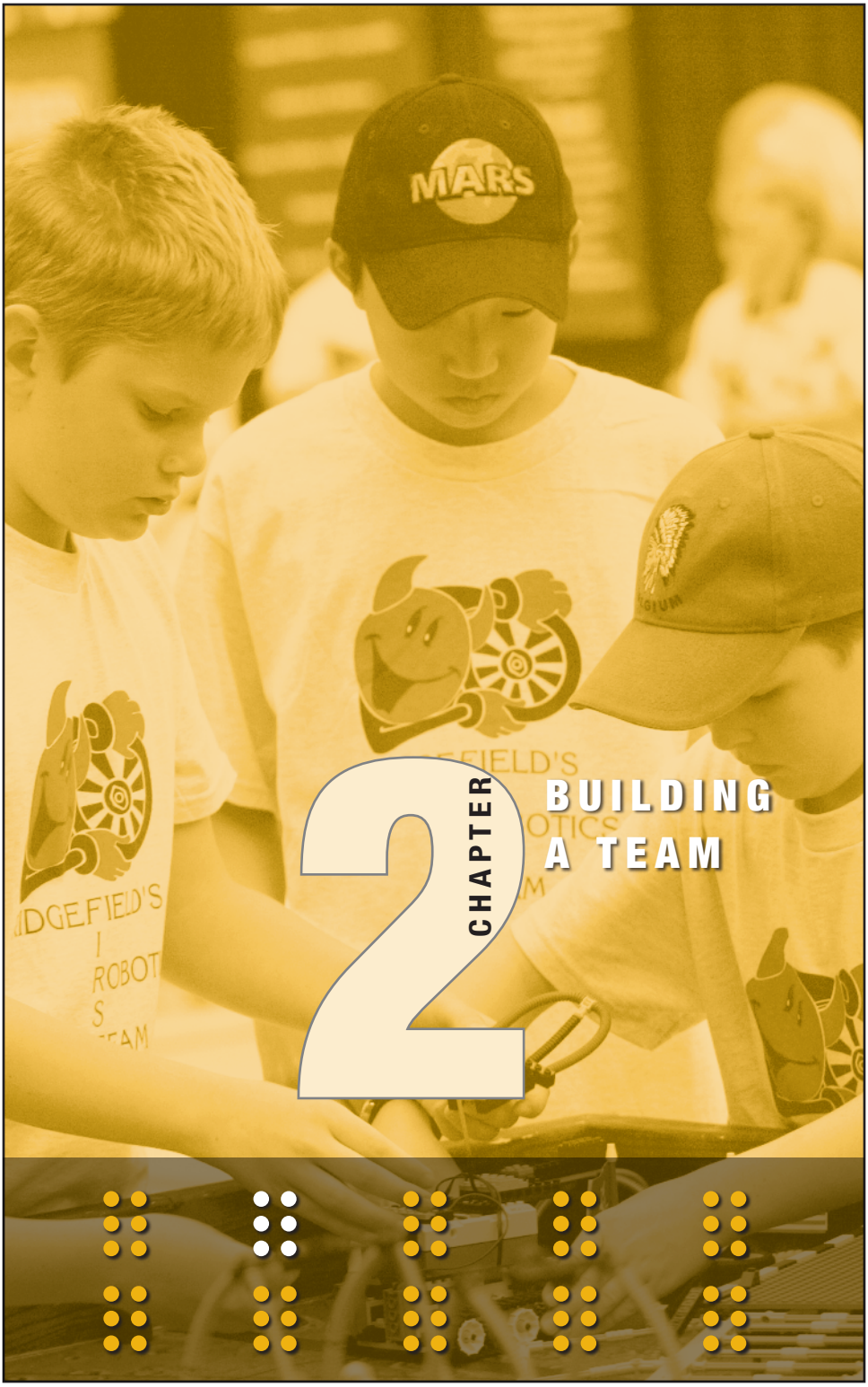
FLL expects team members, coaches, mentors, parents, and other family members to model good behavior and uphold FLL values.

robots that must perform a series of tasks, or missions.

In the **project,** teams conduct research and create a technological or engineering solution to an aspect of the Challenge and present that solution.

For roughly eight fast-paced weeks, each team is guided by at least one adult coach and works as a group to overcome obstacles and meet challenges while learning from and interacting with their peers and adult mentors. Teams work to find creative solutions to the problems presented to them in the Challenge. They then compete in optional local and regional tournaments where they celebrate their accomplishments with other FLL teams, family, and friends.

After the hard work and a lot of fun, children come away with a greater appreciation of science and technology and how they might use it to positively impact the world around them. In addition, they cultivate life skills such as planning, brainstorming, collaboration and teamwork, as well as research and technical skills.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CHAPTER
2
BUILDING
A TEAM

Coaching an FLL team can be one of the most rewarding experiences of your life. And like any great reward, it involves a commitment of time and energy.

THE FOUNDATION

To succeed, both the coach and the team members must commit to the entire process. Above all, it's important to remember that the children need you to give them guidance and provide structure, encouragement, and most of all, a fun experience.

> **TIP**
> Use the FLL websites. The *FIRST* website (usfirst.org) has curriculum resources. The FLL forum on firstlegoleague.org contains a message board where you can post questions and read or reply to existing messages. It contains a wealth of information. See the appendix for instructions on using the forum.

Teams require at least one adult coach. As the coach, you must be 18 years or older. Lots of people make good coaches such as parents, teachers, engineers, college students, and scout leaders. It requires no special skill, just patience, dedication, and a willingness to learn alongside the team. You will need to direct the process the team follows to solve the Challenge without providing the solution yourself.

In addition, you must be willing to acquire some basic knowledge of the programming environment and LEGO robot building. We encourage you to enlist the support of a technology mentor or guest speakers for additional assistance. We also recommend that you invite people with backgrounds in engineering, programming, and the science of the Challenge to share their knowledge and experience with your team.

Advice for Coaches

Don't take this too seriously! We want you to enjoy the experience. Our goal is for you to help the children have fun with robots while they get comfortable with technology and learn something about a real-world problem. Whether or not your team scores high marks at a competition, team members win just for participating. If you throw in a discussion about friction while they eat pizza, you're doing a great job.

If it is your rookie year, enjoy it for what it is: a survey of the course. Your goal should be to simply take a lap around the block with FLL. With a fun experience and meeting realistic goals under your belt, you and the children will be brimming with ideas about what you plan to do next year.

The Children

REMINDER
An FLL team includes a maximum of ten children. In addition, each child may participate on only one FLL team.

Your FLL team will have up to ten children, ages 9 to 14. For a true team experience, we recommend a minimum of three children per team. To be eligible, a child cannot be older than 14 on January 1 of the year the Challenge is announced. For example, a student who turns 15 in May of 2007 would be eligible to compete in the 2007 season, whereas a child who turned 15 in December 2006 would not.

Children come to the team from many different avenues such as schools, after-school programs, home-school groups, Girl Scouts, Boy Scouts, Girls Inc., Boys & Girls Clubs, YWCA, YMCA, Big Brothers-Big Sisters, religious groups, and neighborhood groups.

The Mentors

A mentor is any person who works with the team in his area of expertise for at least one team meeting. Mentors help provide valuable one-on-one interaction and serve as resources in their specialties. Here are some mentor types and possible team contributions:

- **Engineer –** Teaches the necessary skills for the robot's design or the project presentation.
- **High school *FIRST* Robotics Competition member –** Helps team work through a practice programming challenge, shares strategizing methods, serves as a possible youth role model.
- **Science professional –** An expert in this year's Challenge subject, presents real examples of science in practice, advises the team on the project research and its solution, recommends new sources of information for the team.
- **Graphic artist –** Provides advice on the team logo and T-shirts.
- **General volunteer –** Schedules meetings, provides transportation and snacks, helps with fundraising, and provides carpentry assistance for building table borders.

- **Programmer –** Teaches the team about programming principles and helps the team troubleshoot programs.
- **Marketing expert –** Teaches the children about marketing the team to others.

When recruiting a mentor, be sure to consider diversity. Children from diverse backgrounds may be more comfortable if there are adults with backgrounds similar to their own. Below are just some of the sources to recruit a diverse group of mentors. You can visit their national websites to connect with someone from a local chapter:

- Society for Women Engineers (SWE)
- National Society of Black Engineers (NSBE)
- Society of Hispanic Professional Engineers (SHPE)

Other sources for mentors include organizations that strongly encourage their members to volunteer in the community, such as:

- Local chapters of the American Society of Mechanical Engineers (ASME)
- IBM On Demand Community
- Leading corporations in your community
- Senior Corps

TIP

It is a good idea to have the parents review and agree to the **FLL Coaches' Promise** to reinforce the goal that the children do all the work. Parents may want to help, but remind them it has to be hands off. Additionally, you might consider holding a meeting for parents at the start of the season to set expectations and recruit mentors.

Be sure to use the search engine on the *FIRST* website (usfirst.org) for a variety of mentor documents, resources, and links.

The Parents

Parents of team members often volunteer to help. Their cooperation and support are invaluable. They can help with fundraising, logistics, team building, mentoring, or opening their homes for a team meeting. A parent could handle all of the paperwork for tournaments or coordinate the team's travel arrangements. Another could coordinate the materials and resources the team needs throughout the season by finding how-to guides and expert resources on the FLL Challenge topic, or leading brainstorming practice and teambuilding activities.

If your team has more than one parent volunteer, make the most of your good luck by asking a parent to read the FLL team forum on the Web. And don't forget the most important volunteer duty — organizing refreshments so your team never runs out of fuel. As coach, you can perform all of these tasks, but sharing the workload makes your team more efficient, reduces stress, and increases team spirit and cohesion.

SNAPSHOT

Columbia University junior Wayne Penn began his *FIRST* career as a member of the ThunderChickens, a *FIRST* Robotics Competition (FRC) team from Washington, MI.

Wayne serves as the director of Columbia Robots for Academic Inspiration, a campus group dedicated to mentoring middle and high school students from the South Bronx, NY in FRC and FLL.

"Robotic sports are fun for everyone," says Wayne, "but we want each of these children to walk away with a new sense of self-confidence, teamwork, and belonging. Our end goal is to assure that each student has the motivation and support to graduate from high school and go on to college."

Currently mentoring seven FLL teams (four of which he helped start), Wayne's goal is to have an FLL team in every middle school in the Bronx within three years.

TEAM DYNAMICS

Team Size

There are advantages and disadvantages to any team size, but teams must not exceed the maximum of 10 members. Some coaches believe small teams may concentrate better, work as a unit more easily, and provide team members with more opportunities for attention from the coach or mentors. Other coaches believe that larger teams have an advantage because they share the workload and can break into sub-teams to work on tasks.

Breaking larger teams into smaller workgroups works well with this age group as it encourages collaboration. One group can work with a coach or mentor on mechanics while others learn software or work on research. Some coaches believe rearranging members into sub-teams from meeting to meeting helps avoid cliques, builds appreciation of all the team roles between members, and bonds the team. Regardless of your team size, the most important thing is to give your team the best experience possible with the resources you have.

SNAPSHOT

We had 22 children show up for the first FLL meeting. They all decided to register, and we now have three teams. As far as picking the best combination of children, sometimes your choice as a grownup will lead to a very flat team. Be sure to choose a team with a diverse range of skills, keeping in mind that children who are more challenging in the classroom will often shine on an FLL team because of the hands-on and self-directed nature of the activities.

Age Variations

Depending on the age and development of the team members, you may see two distinct developmental phases with mixed-age teams. Younger children often want to take apart and completely rebuild a robot that isn't working, while older children will often want to stick with the current design

TIP

Be aware of age and gender-based cliques. When you see members excluded or the focus moved away from the whole team, discussions and role rearrangements can help.

and alter it. When working together, the two groups may frustrate each other. Neither method is right or wrong; the children are just at different developmental stages. For team members 11 years of age and younger, you and the mentors may consider:

- Presenting problems or explanations visually or with hands-on examples.
- Allowing the students time to understand the game and missions through manipulating and testing repeatedly.

For team members older than 11, you and the mentors may want to:

- Create a structure that encourages crazier, out of the box ideas.
- Provide older team members leadership opportunities, such as explaining ideas and the next steps to the rest of the team.

Time Commitment

FLL teams meet for as little as one hour to up to ten hours a week. The time commitment will vary due to your coaching experience and your team's dynamics. It is up to you and the team to decide what your meeting schedule should be. A rookie team typically needs to meet more often than a veteran team. A new team can have a learning curve and may need to have longer, more frequent meetings. Set your team's schedule according to its goals. We suggest starting with two meetings per week that are two hours long, and adding or subtracting time as your team's needs indicate.

As the coach, you may need additional time each week to prepare for team meetings. Spend this time coordinating help, maintaining equipment, communicating with your sponsoring organization, purchasing supplies, registering for competition, and reading the forum discussions on the FLL website. Create a realistic meeting schedule and don't forget to consider major holidays and school events. You can refer to the sample schedules in Chapter 9: Checklists and Schedules to see how other coaches plan their seasons.

Some meetings will run like clockwork and others will be more challenging. You must accept both. Learn from everyone's mistakes and continue with a smile.

Time vs. Progress

> **TIP**
> If you are planning to attend an event or tournament, check the dates. Some take place as early as November and some are as late as January.

FLL has seen teams with very late starts, in some cases as late as week five in the typical eight-week season. These teams often do as well as teams who started in week one or earlier. The bulk of FLL work is usually done in a span of three or four weeks, so a team that starts late can still do well. The team that gets an early start takes a while to ramp up and make progress. They often second-guess themselves, and usually go through some sort of crunch time in the last week or two, winding up at the tournament showing about 70-80% effectiveness compared to an average veteran team. This is fine.

The late or rushed team is all business for three or four weeks, maybe with some more pressure and no time to regress, and winds up showing about 70-80% effectiveness compared to an average veteran team. We have lost count of the number of post-tournament reports from teams who were worried they were too late and ended up having a blast.

ROLES AND RESPONSIBILITIES

The Coach

There are as many ways to coach an FLL team as there are teams. Some organizations take conformity to the extreme, but FLL encourages fresh thinking. Let your team celebrate its own style. Do what makes sense for you. With that said, consider certain guidelines.

As much as you might like to build it, the team must design and build the robot, not you or any other adult. If you find yourself pushing a solution, you're doing your team a disservice. Not only are children not thinking for themselves, but you may also suppress a revolutionary idea. Additionally, a coach or other mentor doing the work sends the children the message that they are not capable of doing the work. FLL defines children doing the work as children making all critical decisions in the robot-building, programming, and project development processes.

Does this mean you should stand idly by while your team struggles with the Challenge? Absolutely not! You must be involved, but you cannot

be involved in an overtly direct way. Instead of telling the team to "build a gearbox using a worm gear," you could ask the team to brainstorm ideas to make the robot go slower. Or you could encourage the children to run an experiment that may lead them to explore other options.

Coaches differ in how much instruction they give their teams. Some give very little and others give much more. A successful FLL coach controls the process, not the content. You are a facilitator to help your team complete its work and improve the way it works together. One useful coaching method is to reply to a question with another carefully considered question. The following examples force team members to use their knowledge of science and hypothesize logical outcomes:

"What would happen if . . ."

"And then . . ."

"How will that affect . . ."

Children become problem solvers by finding solutions themselves! We understand that adults can be just as passionate about FLL as children, but adults must always remember that **THE CHILDREN COME FIRST.**

Finally, you are responsible for the planning and scheduling of meetings, visits, and trips. You are the liaison between team members, mentors, parents, and volunteers. It is important that you inform children and parents about what is expected of them in terms of their commitment to the team each step of the way.

The Team

Discuss responsibilities with the whole team. It is important for you to be specific when talking about each individual's role and responsibilities. Team members will usually have ideas about what they want to do: programming, building, research, marketing, etc.; but be aware of the child who might be pushed out of doing what he really wants to do. Also, be mindful of those who avoid certain tasks. Remind the children often about the importance of collaboration and teamwork.

Encourage team members to push the limits of their own comfort level and make sure everyone understands or does more than one job. Rotate roles so everyone has an opportunity to try different things.

Children often discover that they enjoy a task they wouldn't have volunteered for on their own. This can also prevent boys and girls from falling into stereotypical gender roles.

Below are examples of the roles or sub-teams you may want to establish within your team. Some children may want to be involved in multiple roles. Do whatever works best for your team, but ensure balanced leadership.

- **Research –** Gather information and prepare the project presentation as described in the Challenge.
- **Building –** Make decisions about building and work to build consensus on the mechanical design among team members.
- **Programming –** Make decisions about programming.
- **Strategy Analysis –** Analyze the robot playing field and formulate various methods for accomplishing the missions. Lead the effort to establish a consensus on the final strategic plan and think about risks and rewards of different strategies.
- **Robot Operators (2) –** Operate the robot at a tournament. Two robot operators are permitted at the playing field at any given time (see Tournament section for details).
- **Project Management –** Get everyone focused, get everyone's ideas heard, find compromises, and keep everyone on schedule with a project timeline.
- **Quality Control –** Conduct independent tests of the robot's performance to

TIP

When my team is frustrated or the team members have a bad day, we take a few minutes to play the game Sandman. In this game, the child who is "it" tries to make the others laugh. Once you laugh, you're out. It means losing the game, but it feels so good to laugh! The team that successfully creates a balance between work and play will feel successful in other challenges.

REMINDER

Do not worry if you don't fully understand some skill or aspect of the Challenge. You can work through it with the team members. In fact, it may be to your advantage. Children love to solve problems that befuddle adults. It promotes creative thinking among children when you have no answers to influence them.

identify potential opportunities for improvement. Test for functions that do not work reliably and make recommendations for improvements.

- **Marketing –** Design and create the team logo. Write a press release and contact the local media, surrounding schools, or civic organizations to increase public awareness of the team and how the team benefits from the FLL experience. Communicate a weekly update on the team's progress to parents, sponsors, and organizations.

- **Documentation –** Record and document the entire team's thoughts, actions, failures, and successes throughout the FLL season in a journal, storyboard, video, or other form you can display or present at events. During the season, these efforts help the team organize information for decision making. At events and tournaments, these are an excellent way to showcase the team's activities, teamwork, and spirit for the judges and event attendees.

- **Fundraiser –** Think of ways to raise money for the team. Recruit parents and other children in the thinking, planning, and doing processes.

- **Team Spirit –** Think of ways your team, families, and friends can show their spirit at the tournament. As part of your team's identity, consider designing T-shirts, making pins, writing a cheer, and inventing ways to showcase your spirit.

Team Goals

An early step in preparing to coach a team should be to work with your team to set goals for the season and put them on paper. Include expectations for the group's success at functioning together as a team. As the coach, write down what concepts you expect the team to learn by the end of the season.

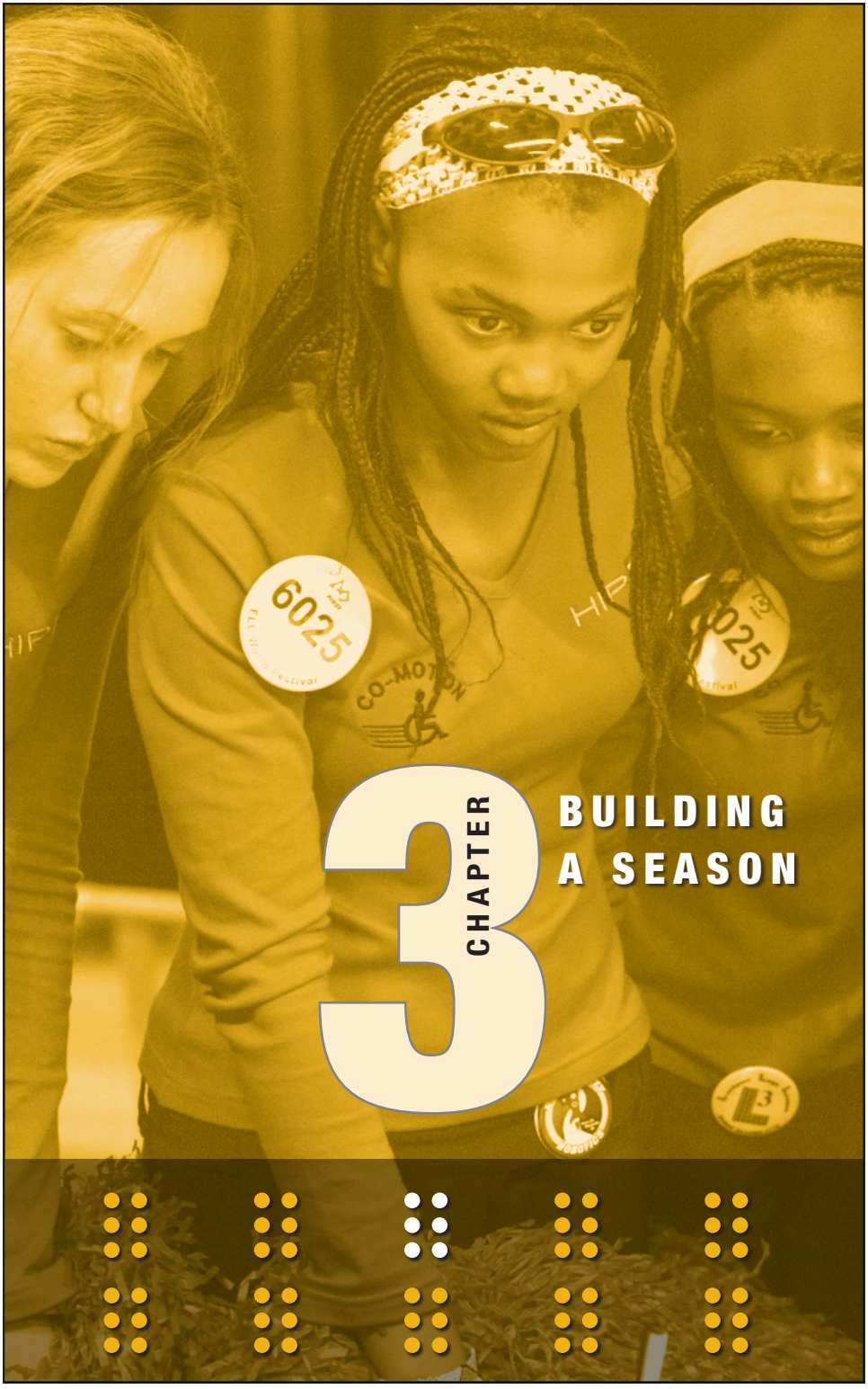
TIP

MISSION: A mission is a job the robot can complete for points. Missions can be attempted in any order, alone or in groups, re-attempted when possible, or skipped. Teams earn points if the required results on the field are still visible at the end of the match.

FLL events provide excitement and recognition and celebrate each team's accomplishments. The true goals of FLL have nothing to do with winning medals or trophies. If you can look back at the end of the season and say even one of the following, you have achieved the most important goals:

- We learned how useful and fun math and science can be.

- We did something we didn't think we could do.
- We respected and considered ideas from everyone on the team.
- We helped our community.
- We improved over last year.
- We figured out how to manage time, deal with setbacks, or communicate ideas.
- We learned that research helped us better understand a problem and build a realistic solution.
- We had fun!


CHAPTER
3
BUILDING
A SEASON

For pre-kickoff, there are a number of things we recommend to both new and returning coaches to prepare for a successful upcoming season. If there are any FLL events in your area, consider attending as a spectator. You will see the flow of the day, meet coaches, talk to teams about their experiences, and witness the high level of energy firsthand.

GROUNDWORK

> **ROOKIE TIP**
> Check out past FLL Challenges on the FLL website (firstlegoleague.org).

Talk to your local FLL Partner, listed on the FLL website (firstlegoleague.org), to get answers to a lot of your questions and to get in touch with experienced coaches in your area. Try building practice robots, both by yourself and with your team. Try completing some of the programming mini-challenges available year-round on the *FIRST* website (usfirst.org).

Long before the September Kickoff, we offer teasers and announce the theme (see a sample season schedule in Chapter 9: Checklists and Schedules). Take some time with your team to brainstorm ideas about the new theme. As a team, do a little research on how technology is used in the theme's field. Think about project topics that might interest your team and look for mentors who can offer topic insight.

Choosing a Facility

> **TIP**
> By using the host site and playing field at different times, multiple teams can share the space and equipment. Storage for the playing field or table between meetings is an important consideration. Many coaches recommend finding a designated storage space in the same location where the team meets. This makes post-meeting cleanup much easier.

You need a computer, either a Macintosh or PC, with Internet access. This is necessary for viewing the documents for Kickoff, accessing the team forum, and conducting research for the project. You will also use a computer to develop programs for the team's autonomous robot. You will need a valid email address to maintain contact with FLL throughout the Challenge season.

Figure out where to host team meetings. Your host site will need a smooth floor space for the 4' x 8' mat

or the optional FLL table. Without the optional legs and lights, the table is simply a 4' x 8' sheet of plywood with a 2" x 4" border around the perimeter of the plywood.

Your team can meet wherever is appropriate. For a school-based program, the school itself is ideal. Schools usually have the computers and space to set up your playing field. For teams not based in schools, you may meet in a private home, a meeting hall, or a company conference room. Find enough space to host your entire team, the competition table, the computers, and all your LEGO bricks. You also need a secure place to store the FLL robot set and partially assembled robots between team meetings. Evening or weekend use of the building may require special authorization. Be sure to ask permission to use the site's computers to program the team's robot and to complete the research for the project. Before installing software, inform the site host.

SNAPSHOT

We are lucky to have the school's science teacher as the club advisor. He allows us to store everything in his room. When we don't want to leave materials in his room, we store materials in my car.

It helps to make a border for the mat that can fold up so it can be moved easily. We store everything but the border and the mat in a large plastic bin for easy hauling.

SNAPSHOT

Our home school team is lucky to have the basement of the coach's house for our practice area. We have to be careful about putting our robot away where younger brothers or sisters can't take it apart between team meetings. Our playing field stays in the same place from week to week.

Working with Your Host

Meet with the person in charge of your host site. Explain the concept behind FLL and that the benefits of having a team extend far beyond the team members. When you meet the person in charge of the site, ask for a volunteer to act as liaison between the team and host. The liaison should update others at the site on the team's progress. Email your liaison a progress report once or twice a week.

Ask your site liaison to explain any adult supervision and child safety requirements to you and any team mentors. In some schools, adults who meet with students after hours in a non-supervised environment must have a criminal background check and be fingerprinted. This is often done at the school's expense, but not always. Ask all volunteers to submit to this simple procedure if necessary.

Funding a Team

We know some teams will need to do some form of fundraising to pay for participation. Fundraising as a team builds unity and develops enthusiasm for success, and besides the obvious monetary benefit, it fosters a sense of ownership in the team. Brainstorm with your team members for creative fundraising ideas; they'll surprise you with some fresh ideas.

There are many ways to fund your team. Obviously, you could write a check from your personal funds or split the bill between the team members. Splitting the bill may be a large expense for some families, and you run the risk of excluding children if you use this method. Seeking a sponsor and doing other fundraising can spread awareness and support of FLL.

Look for a company in your community to sponsor your FLL team. Many companies that support FLL recognize how it encourages a talented future workforce. To help win them over, offer to put the company logo on your banner or T-shirts to thank them for their generous donations. Update donors or sponsors regularly, and remind them how their contribution helps inspire a life-long appreciation for science and technology, as well as lasting intellectual and life skills.

Sample Budget (based on 2007 costs)

Assuming no in-kind donations such as goods or services.

REQUIRED ITEMS	COST	COMMENTS
Team Registration Fee	$200 USD $235 CAD	Non-refundable
FLL Robot Set (NXT)	$325 USD $435 CAD	**Recommended for new teams; can be reused for more than one year**
FLL Field Setup Kit	$65 USD $78 CAD	Recommended for every team; changes every year
TOTAL (REQUIRED ITEMS):	**$590 USD $748 CAD**	

OPTIONAL ITEMS	COST	COMMENTS
Official Table	$70	Surface and borders $25-$30; sawhorses $30; lighting $10
Tournament Entry Fee	$50 or more	Varies
Tackle Boxes	$10 per box	For storage
T-shirts	$2-$10 per shirt	
TOTAL (OPTIONAL ITEMS):	**$130+**	

Other expenses include: shipping, miscellaneous supplies such as markers, paper, toner cartridges, color copies (building instructions), scissors, folders, posterboard, binders, other office supplies, snacks, and travel expenses.

TIP

Go to www.firstlegoleague.org for table building instructions.

SNAPSHOT

Write a letter from the team requesting financial and/or mentor assistance. Describe what the team hopes to do with that year's Challenge and how it can impact the children going into science, math, engineering, or technology-related careers. Many companies have a foundation which may offer support, or they may be so impressed by the letter a group of children wrote that they offer to help.

Other Fundraising Ideas

Pick a fundraiser that is appropriate for your team and your community. Make it fun. The more fun you have holding the fundraiser, the more donors will want to be part of that excitement.

When raising money for your team, be sure to ask community groups to support you in any way they can. Think of fundraising ideas that don't require additional volunteers or a greater time commitment. A number of major retail franchises match money raised at their sites, while others offer community groups free or discounted products. Be sure to call local businesses and ask them what they might do to help you. Every little bit you raise is helpful!

TIP

When going to talk to a potential sponsor's representative, bring a working robot. If you don't have a kit, borrow one. Make a sample robot using instructions from the kit or other resource and bring it with you. Nothing speaks louder than a robot doing its thing, but you may also want to create a fact sheet or press release about your team.

Some fundraising ideas include:

- Hold a bake sale or carwash.
- Hold a raffle of items donated by parents or local businesses.
- Write letters or proposals to foundations that support youth programs.
- Sell balloons for $5 each. Some contain donated gift certificates, others have a thank you note from the team.
- Organize a reverse raffle — Guests receive a raffle envelope at the door of an event, with an assignment inside. They have to sing the national anthem — or buy their way out of it! They pay twice as much to assign the task to another attendee.
- Kiss the turtle — Recruit a few volunteers at a school or community gathering. Put out jars with each volunteer's name. Attendees put money in the jar of their

choice. The person whose name is on the jar with the most money kisses a turtle, or pig, or silly object of your choosing at the end of the event.

Challenge Kickoff Meeting

The Kickoff date for the FLL season is in mid-September. Be sure to check the FLL website for details. At Kickoff, you can access all materials related to the new Challenge. You can download the Challenge project guidelines, access the rules of the new robot game, and view a playing field. There may also be other materials such as an illustrated story or article to share with your team. See the appendix for a list of Kickoff documents.

Many teams gather on Kickoff day for a team party to celebrate the new Challenge. For some teams, this meeting is a season opener. Download the materials together and come up with a game plan for the new season!

Early Season Meetings

It's time to get started. Use the following list of suggestions to help organize your team meetings at the beginning of the season.

- Give each team member a folder. Have all the children put their names on folders and decorate them. Have team members bring their folders to meetings and use them to hold important papers.
- Play a game to learn each other's names. Do this at the start of each meeting until team members know each other—and until you know their names.
- Hand out the FLL robot kit and, if applicable, the tackle box or other organizational system you plan to use. Let the children sort the kit as they see fit. This is a good time to go over your expectations about how they will keep the kit neat and organized.
- Print and hand out the field setup kit and the mission model (LEGO element) building instructions. Have the children build the models, then place the models on the playing field in the appropriate positions. When done, have other team members look everything over to make sure the models are properly built and correctly placed on the playing field. This is an opportunity for you to talk about quality control.

TIP

All children in this age group need healthy snacks and beverages. Having snack time as the first thing you do will calm the children down and allow you the time to talk to them about the day's activities.

- After your initial robot brainstorming sessions, the team may have several concepts for the chassis as well as various attachments. Sub-teams can either design or make a prototype during the next few meetings. This allows them to test multiple ideas in a shorter time, then incorporate the best parts of each prototype to make the final robot.
- Start brainstorming ideas for this year's Challenge project.

TIP

Get a large sheet of paper and make a calendar for the team. Be sure to add meetings and important dates. Set major goals in pen and minor goals in pencil or on sticky notes. Bring the calendar to each meeting and update it to include in the team business part of your meetings. It's good for the team to actually see their progress. Refer to the sample schedules in Chapter 9: Checklists and Schedules, to see how other coaches plan their seasons.

Team Building

Team building exercises allow members to communicate feelings in a positive and healthy manner and encourage gracious professionalism as they work together toward a common goal. They're also fun. Team building can be difficult with a schedule that is very structured. Sometimes letting children have fun together allows them to develop communication and respect, leading to smoother progress when work resumes. Here are several team-building exercises you can try with your team.

1. Interview activity

Invite team members to interview their teammates and learn something about each other. Have them pair up and ask each other relevant questions.

Sample questions could include:

- What is your favorite activity or hobby?
- If you could invent something to change the world, what would it be?
- Do you have a favorite pet story?
- What is your favorite time of year?
- What is the best advice anyone ever gave you?
- What are three things the whole team has in common?

Consider adding your own questions that pertain to this year's FLL Challenge. Appoint a child from each of the pairs to introduce his partner and share what he has learned about his partner with the team.

2. Host a team-building meeting

This is a time for everyone to become comfortable with each other.

- Work together to come up with a team name and logo.
- Create projects unique to your team such as hats, a handshake, and a cheer.
- Think, pair, and share – have each team member pretend he is the robot. Write down the steps/instructions required to move around an obstacle in the room. Create pairs, and have one child read his instructions to the other child who acts as the robot.
- Same and different – create a task and ask each member to write down how he will complete it. Have each share ideas with a partner, then with the group.
- If you haven't already, start building the mission models and assemble them on the playing field.

PROBLEM SOLVING

Keep it Simple, Silly — KISS

Introduce KISS, "Keep It Simple, Silly" to your team. In the engineering world, simple solutions are much more desirable than complex ones. The complex solution has many more places to fail, is more difficult to repair, costs more, and its operation is less intuitive.

Consider the fate of the high tech electric potato peeling gadget. How many are still in use? Why did they vanish even if they were faster than a normal peeler? Was it the bothersome cord, the difficulty in cleaning, the big fat handle, or perhaps the motor that kept burning out?

Does this mean all high tech devices fail the KISS test? Of course not. For example, microwave popcorn is more high tech than kernels and oil in a pan, but it's much simpler.

Students are sometimes drawn to complex solutions. Keep reinforcing the KISS principle, asking the team to distill their ideas down to make the

solution as simple as possible.

Supportive Learning Environments

Once the Challenge is unveiled, the children will often drive the goals of the team. This is perfectly acceptable and gives you a chance to step back and watch their progress. Encourage the children to brainstorm. It's an important part of a team's planning process, and brings out creative ideas and produces better-thought-out solutions.

When you lead discussions or make suggestions, give choices to the team members. Facilitate the process the team follows to reach its goal, but allow choices within that process. One way to do this is to offer options to the team where every outcome is acceptable. That way, there will be no wrong answers. As coach, you then help the team reach consensus in a fair way.

A mutual foundation of trust and respect is critical for a supportive learning environment. Everyone's voice must be heard, and all ideas listened to with a patient and open mind. Part of your role is to listen to team members and keep lines of communication open. While you may not be able to use every idea or suggestion, hear them out. Clear expression of an idea and convincing others is a great learning experience.

TIP

A useful tool to empower team members is to schedule time for them to demonstrate what they know to their peers, teachers, parents, and community, both in terms of content and application.

Be aware of verbal and non-verbal cues and interpret the conversation to help the team work through communication difficulties. If you validate team members' feelings, they are more likely to discuss problems. Sometimes acknowledgement or positive feedback may be all the response a team member needs.

A frustrated child might cross his arms over his chest and refuse to face teammates. It is your job to help this child re-join the team. Keep in mind that we all deal with stress differently. One child might feel the need to walk away to reclaim personal space and another might attack the conflict head on.

Group Awareness

The coach must be aware of and help regulate group dynamics. Be conscious of personalities and interactions between team members. If a dispute arises, help the team resolve it and then re-focus everyone on a productive task. Effective coaches use the similarities and differences of team members as assets to help the team get work done.

Q1: I have a team of nine boys who love to chatter, and after two minutes without instruction, they kind of get off track. I have some ideas for activities to keep them focused, but the team needs to start cracking down on the Challenge. Any suggestions?

A1: Each meeting, have a practice tournament and have the children run the robot on the table and give their project presentation. It is a powerful way to have them realize how much work is left to do. This year I started doing this from the second meeting. I gave them five minutes to prepare, two and a half minutes at the table, and five minutes for the project. At first, the team objected, but quickly got to work to better their performance for the next meeting.

A2: I had a similar challenge last year with a gregarious 15 year-old mentor. We finally decided, after much discussion, that his role was to ask questions of the team — lots of questions. Why does your robot do this? How? What else? What's another way? We made it his goal to ask at least ten productive questions per meeting.

Q2: Our team is enthusiastic and engaged for entire meetings — until it's time to clean up. Any suggestions for getting housekeeping in order?

A1: Cleanup, of course, is the least favorite part of all meetings. Who wants to clean up? Who wants to stop working on the robot? Who wants to go home and take a bath or go to bed? On our team, each member picks a cleanup job. When that team member's job is done, he takes a seat so I can see the progress and send help if needed. This way, they don't distract each other.

A2: One way to encourage cleanup is through a point system. Working in pairs during cleanup, children can vie for awards or recognition.


CHAPTER
4
MATERIALS &
MECHANICS

In this chapter, you'll find an overview of the key hardware and software components for FLL. You will learn what each element does, why it is important, and how it can help your team.

MATERIALS DEFINED

Playing Field

The playing field consists of the LEGO mission models on the mat, bordered by black 2" x 4"s, on a smooth, flat, hard, uncarpeted, level surface (usually a piece of 4' x 8' plywood).

Support for the playing field and borders may vary. You can use the floor, but most teams use plywood. Some teams put their surface and borders on sawhorses or milk crates, others build a supporting structure. Of course, none of this matters to the robot: only the surface and borders do.

Every team must decide whether to add lighting to its playing field. Instructions for lighting are provided with the table building instructions. There is no way to ensure that your lighting will be the same as the lighting at a tournament, and no way to ensure that the lighting at one tournament will be the same as the lighting at another. That being said, your team can mimic the conditions somewhat by building a table with the recommended fluorescent lighting hanging above it. Teams that use light sensors on their robots need to test in a variety of conditions and be prepared for changing lighting conditions. The basic details of tournament lighting are available on the FLL website.

A NOTE FOR ROOKIE TEAMS

In your rookie year, you need to purchase two kits: the FLL Robot Set and the FLL Field Setup Kit. In subsequent years, you will only need the Field Setup Kit, as the game and theme will change each year but the Robot Set most likely will not.